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ABSTRACT

Students from an undergraduate course in the experimental analysis of behavior and from an honors section and a night class section of introductory psychology were exposed to a contingency program designed to produce the same specified terminal performance in every student. The principles underlying the course administration, scheduled activities, assignments, quizzes, and course grades were explained to the students at the initial class meeting. The subject matter for each course was divided into weekly units, and each student was given a unit assignment sheet consisting of approximately 30 questions. A quiz consisting of a sample of nine or ten questions taken directly from the assignment sheet was given weekly. Activities or quizzes could be repeated as many times as necessary to obtain a minimum grade of "B." With the exception of two students who obtained a grade of "B," all students obtained an "A" as their final course grade. Responses to a course evaluation questionnaire indicated that students clearly understood their responsibilities, felt the grading was fair, felt their comprehension of the subject matter was above average, and were stimulated to take other undergraduate psychology courses. (Author/RT)

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Abstract

Production of Specified Terminal Performances in Every Student in Undergraduate Psychology Courses[1]

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Students from an undergraduate course in the experimental analysis of behavior and from an honors section and a nightclass section of introductory psychology were exposed to a contingency program designed to produce the same specified terminal performance in every student. The principles underlying the course administration, scheduled activities, assignments, quizzes, and course grades were explained to the students at the initial class meeting. The subject matter for each course was divided into weekly units, and each student was given a unit assignment sheet consisting of approximately thirty questions. A quiz consisting of a sample of nine or ten questions taken directly from the assignment sheet was given weekly. With the exception of two students who obtained a grade of "B", all students obtained an "A", as their final course grade. Responses to a course evaluation questionnaire indicated that students said that they clearly understood their responsibilities, felt the grading was very fair, felt their comprehension of the subject matter was above average, and were stimulated to take other courses in the general area.

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Production of Specified Terminal Performances in Every Student in Undergraduate Psychology Courses[1]

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Individual differences among students has been a problem long recognized by teachers. The most important dimensions along which these differences lie are learning skills, general knowledge, self-management of activities and background information for any particular course content. At the college level these differences are taken into account in only a very general way by requiring prerequisites for courses and separating courses into graduate and undergraduate levels. The usual solution to this problem of student differences is to include materials in a course which vary in complexity and, therefore, have something to offer each level of ability represented. Presenting materials which vary in difficulty to students who vary in ability reliably generates the notorious "grade curve."

One way to deal with individual differences in students is to individualize the rate at which a student acquires a set amount of material. Programmed instruction (Holland & Skinner, 1961) and contingency programs (Keller, 1968; Lloyd & Knutzen, 1969; McMichael & Corey, 1969; Sheppard & MacDermont, 1970) have been effective in accomplishing this. Specifically, the contingency programs were successful in generating a set quality of completed work for all students. However, beyond a stated minimum amount of material these programs

allowed the student instead of the teacher to determine how much of the total course material would be acquired. This resulted in the amount of material learned determining the grade received.

Malott and Svinicki (1969) have suggested that if students meet the normal college entrance requirements they are probably capable of doing "A" quality work at that college. As support for their suggestion Malott and Svinicki (1969) found that under a contingency program which required 100% accuracy on quizzes, 80 to 90% of students enrolled in introductory psychology earned a final grade of "A" and less than 2% earned an "F." Myers (1970) has also demonstrated that most students can perform at the "A" level. He found that 37 out of 38 students were able to earn an "A" in introductory statistics under his contingency program. Finally, Johnson and Pennypacker (1971) have described a contingency program of instruction that requires both complete mastery of the subject matter by all students, and a minimum rate of performance. They reported that only 10% of the students in their courses experience any difficulty in meeting the "A" requirements and approximately 95% or better of all students earn an "A."

The purpose of this paper is to describe another method of programming which deals with individualization of rate of acquisition and insures that each student acquires the terminal repertoire for the course subject matter. The advantages of this program will be presented in the discussion. Data are presented for three different groups of students exposed to this contingency program.

Method

The subjects were from an undergraduate course in the experimental analysis of behavior and from an honors section and a nightclass of introductory psychology. The texts and class standings of the students are described below.

The texts for the experimental analysis of behavior course were The Analysis of Behavior (Holland & Skinner, 1961) Tactics of Scientific Research (Sidman, 1960) and The Experimental Analysis of Behavior (Verhave, 1966). Four freshmen, nine sophomores, 24 juniors and 13 seniors were enrolled in the experimental analysis of behavior course; the class met twice a week for 75 minutes.

The honors section and the nightclass section of introductory psychology used the same text, Basic Psychology (Kendler, 1968), unit assignments and quizzes. Twenty-three freshmen, two sophomores, and one junior were enrolled in the honors section. Four freshmen and one junior were enrolled in the nightclass section. The honors class met twice a week for 75 minutes, and the nightclass, once a week for 165 minutes.

At the first class meeting principles underlying the administration of the course, scheduled activities, assignments, quizzes and course grades were explained and are summarized below.

Explanation of Course Administration

The following explanation was given to all students: "The purpose of this course is to develop a repertoire in each student for the subject matter defining the course. The subject matter is presented in the assigned text and readings. The instructor's role is secondarily to supply

facts and principles regarding the subject matter; his main function is that of contingency manager. In the latter role the instructor will spend most of his time preparing and grading quizzes which assess the development of each student's repertoire, and in insuring that the relation between course activities and final grades is such that all students will acquire the terminal repertoire for the course.

It is common knowledge that students differ with respect to learning skills, general knowledge, self-management skills, and background preparation for a course. The solution to this problem of individual differences that most instructors choose is to present materials which vary in difficulty, such that few students are able to acquire everything presented. The interaction between student differences in ability and course materials varying in difficulty generates what is known as the typical grade "curve." Another approach to this problem of student differences is taken in this course. What constitutes an adequate repertoire for the course has been defined, and the course is so arranged that all students can acquire the repertoire. Rather than have individual differences generate different amounts of knowledge with their associated final grades, in this course student differences will reflect the time required for preparation. Thus, all students can acquire the terminal repertoire; the time taken to reach the repertoire within certain limits will not affect the student's course grade."

Scheduled Activities

Experimental Analysis of Behavior class. On Thursday, students were given a quiz on the unit of assigned reading for that week and the

written assignment sheet for the next week's unit. The instructor told the students that it was expected that they interact with each other in obtaining the answers to the unit questions. To facilitate student interaction a list of all students and their telephone numbers was distributed. If none of the students were able to answer a question, it was to be referred to the instructor. The graders for each quiz were one-fourth of the students in the class and were appointed semi-randomly by the instructor such that each student served as a grader an equal number of times. While the remainder of the class answered the quiz, the instructor coached the graders on how to grade the quiz. As soon as all students had finished the quiz, grading was initiated. Following Keller (1968) students were allowed to defend any "incorrect" answers. This provided immediate knowledge of results to the students. The graders received the maximum number of points for the particular unit. Before the quizzes were returned the instructor inspected them to insure that the grading had been fair. On Tuesday the graded quizzes were returned and the results discussed. The remaining time in the Tuesday period consisted of a lecture, discussion of current social problems or a film. In general the students were encouraged to suggest what they would like to do during Tuesday, their "free" day.

Introductory Honors class. Except for scheduling the unit quiz on Tuesday and the "free day" on Thursday, the procedure used by the experimental analysis of behavior class was followed.

Introductory Nightclass. Since the night section met for one continuous period, the schedule was different. The quiz was given at the beginning of the period, and since there were only five students the instructor graded all quizzes. Repeats on a quiz were scheduled at the beginning of the next class. Other than these differences the method was the same.

Assignments, Quizzes, and Course Grades

Introductory Psychology Honors and Nightclass sections. The chapters covered in Kendler's (1968) text were divided into weekly unit assignments similar to those described by Keller (1968, p.84). Each unit had a median of 24.5 pages with a minimum of 16 and maximum of 32 pages per unit; the number of pages covered in any unit was usually determined by the judged difficulty of the material. The honors section completed 14 units during the semester; due to scheduling problems the nightclass completed 13 units. An assignment sheet consisting of 25 to 30 questions was prepared for each unit of material. At the end of each question page numbers were given indicating where in the material the answer could be found. For any given unit the questions were presented in sequence from the beginning to the end of the unit. The questions were designed with the purpose that answering them in sequence should assure that later material would be understood. The students were told that the questions pointed out what the instructor regarded as important concepts, prinicples or definitions, and that when all questions could be answered

their study of the unit could be regarded as finished.

The questions on the weekly quiz were taken directly from the unit assignment sheet. A quiz consisted of eight to ten questions ranging in value from one to four points each. The mean number of points on a quiz was 20.5 with a minimum of 18 and a maximum of 25 points. To obtain an "A" on the quiz the student could not lose more than two or three points and for a "B" not more than three or four points. Students receiving a "B" were not allowed to repeat the test to receive an "A". Students not receiving a "B" were required to correctly answer the missed questions (orally or written) the following week. This was done by making an appointment with the instructor or graduate assistant. If the previous unit had not been passed, students were not allowed to take the next unit quiz. The students were not supplied with a specific policy with respect to the number of allowed repeats; however, the instructor told the class that if too many repeats occurred he would institute a policy. Failure to complete all of the assigned units would result in an "F" or incomplete at the discretion of the instructor.

To broaden the students' knowledge of psychology and to assess their ability to analyze articles in terms of scientific method, the following additional activities were required. Students were given a list of Scientific American articles relevant to psychology. Each student was required to choose five of these articles and to turn in a paper for each, indicating the purpose, independent and dependent variables, conclusions,

and relevance of the article to material in their text. Answering all questions correctly on an article was worth ten points; a minimum of 35 points was necessary to pass the course (no "A" or "B" range). Finally, the students had a choice of reading and answering questions on Walden II (Skinner, 1948) or Games People Play (Berne, 1964). The questions on Walden II were the same as those prepared by Lloyd and Knutzen (1969). The questions on Berne's book centered around a learning analysis of games and were as follows: 1. Take any game you wish and translate it into the language used and prinicples found in operant conditioning. 2. What advantages are gained from translating Berne's analyses into a learning language? 3. Do teachers and students engage in games? If so, identify which one(s) they most often engage in by example. If not, explain fully. 4. All of us play games. In order to increase your own self-knowledge, what games do you play? Describe how you might end this or these games. (Your reports will be treated confidentially). 5. Berne seems to distinguish between pastimes and games on the basis of stimuli controlling (S^Ds) and reinforcements provided by each. Analyze each according to the strokes involved using known learning principles. Do the discriminative criteria offered by Berne still hold following the analysis? Explain. 6. Make up your own questions about any aspect of Games People Play and answer it. Keep the emphasis on learning principles. The maximum number of points for each book was 60 points and the minimum to pass the course (no "A" or "B" range) was 50 points. If a student did not acquire the minimum number of points

for the book report or any Scientific American article, he was required to satisfactorily re-write the missed section(s).

The final grade in the course was based on the total number of points accumulated during the semester by each student; there was no final exam. Since all students had to obtain a grade of "B" to move to the next unit, the cumulative points for unit assignments would have to fall in at least the "B" range if the student completed all units. To facilitate self-awareness of progress in the course, each student was given a Self-Monitoring Sheet which listed in columns the course activities, maximum points, grade and points earned and cumulative points for each activity; and the minimum cumulative points for a grade of "A" at any particular time in the course. There was no requirement that the student use the sheet.

Experimental Analysis of Behavior class. Since The Analysis of Behavior (Holland & Skinner, 1961) is a programmed text, its content was divided in a different manner than the rest of the non-programmed material. Specifically, the number of sets, pages and assignment questions for each unit were as follows: Unit 1, Sets 1 to 20, 137 pages and 45 questions; Unit 2, Sets 21 to 41, 140 pages, 36 questions; and Unit 3, Sets 42 to 53, 161 pages, 27 questions. For the remaining material each unit had a median of 33.0 pages and a minimum of 20 and a maximum of 45 pages per unit. The median number of assignment questions for the unprogrammed material was 29 with a minimum of 22 and maximum of 51 questions per unit. There were eight to ten questions on each quiz. The mean number of points

per quiz was 23.6 with a minimum of 18 and a maximum of 34 points. The following policy for number of repeats was followed; On the first repeat the student was reuired to answer only the missed items on the quiz and received the maximum number of points for the quiz; on the second repeat the requirements were the same except the students received the minimum number of points for passing; on the third and any succeeding repeats the student was required to answer new questions as well as the missed questions and received the minimum number of points for passing. Other than the above differences in course content the same procedure used in the honors section of the introductory course was followed.

Course Evaluating Questionnaire

On the last class day students in all courses were asked to fill out the Washington State University Survey of Student Reactions to Courses and Instruction.

Results

With the exception of two students in the experimental analysis of behavior course who obtained a grade of "B", all students obtained an "A" as their final course grade. One of the exceptions was enrolled in a course under the university's pass-fail system; the other was normally enrolled. The number of students repeating quizzes during the semester, and the number of students receiving zero or more quizzes with a grade of "B" are shown in Table 1. Ten students in the experimental analysis of behavior course needed to repeat the last unit quiz but did not. This data is not included in Table 1 because a member of the teaching staff incorrectly informed students prior to the last quiz that

the unit would not have to be repeated if the student already had accumulated sufficient points for a final grade of "A". Most of the students had to repeat three or fewer quizzes. As might be expected, the honors section had the fewest number of repeated quizzes; no student had to repeat more than two quizzes. The nightclass student who repeated five quizzes had a number of study deficiencies; in addition, he was enrolled in two other night courses as well as working full time during the day. Most of the students in the experimental analysis of behavior course had to repeat four or fewer quizzes (Table 1). Since only five students had to repeat five or more quizzes, it seems reasonable to conclude that the teaching staff failed to apply the repeat contingency.

Insert Table 1 about here

The number of students receiving zero or more quizzes with a grade of "B" is also shown in Table 1. Most of the students received four or fewer "Bs" on their unit quizzes. Again the honors class performed best by obtaining the fewest number of "Bs." The nightclass student with seven "Bs" is the same student with five repeats. Considering the fact that the students must adjust to a new teaching system, it seems reasonable that a number of students obtained one or two grades of "B". The students in the experimental analysis of behavior course obtaining five or more "Bs" are the same students repeating five or more quizzes.

Insert Tables 2 and 3 about here

The items selected from the Washington State University Survey of Student Reactions to Courses and Instruction for course evaluation are presented in Table 2. All but ten students in the experimental analysis of behavior course and two students in the honors introductory course responded to the questionnaire. The average and normative ratings for these selected items are shown in Table 3. Compared to traditional courses it is particularly significant that responses to item 1 indicated that average comprehension of course content was above the norm for all courses. Consistent with the contingency method employed, students rated item 2, importance of attending class, lower than the norm. The high rating for item 2 by the nightclass is due to the fact that the class met once a week. The responses to item 3, the amount of outside work in relation to credit hours, was variable. The honors section rated the amount of work slightly below the norm, while the night students felt they were working harder than usual.

All students said that they felt that their responsibilities for the course were well defined; the average rating for all courses was over one point above the norm for item 4. Responses to item 5, pursuit of related courses, indicated that after completing the respective course most students were interested in taking other related courses. Finally, the average ratings for item 6 indicated that students were very satisfied with the grading procedure used.

Discussion

The final grades obtained by all students indicate that the contingency program employed did generate the desired terminal performance. The terminal performance for each student was specified as successful completion of all assigned activities. If the student had not completed all activities by the end of the semester, he received an "Incomplete" or "F" at the descretion of the instructor.

The present contingency program differs in a number of ways from other successful programs (Malott and Svinicki, 1969; Myers, 1970; Johnson and Pennypacker, 1971) for generating the desired terminal performance in each student. One factor for comparison among these programs is the type of quidance provided the student while learning the assigned material. Johnson and Pennypacker (1971) limit their guidance to important points made in pertinent lectures which occur prior to a quiz. Otherwise, until he received his first quiz which tells him what is important, the student is on his own. The present program, Malott and Svinicki's (1969) and Myers' (1970) all provide the student with a set of questions which specify what are the important points in the material covered; this is done to assist the student's preparation for his quiz.

The use of unit assignment study guides in the present study offers a number of educational advantages. The student is assured of identifying important points which might easily be missed in his reading of material or listening to a lecture. Since the role of the lecture is minimized, whether

or not a student will learn an important point is no longer dependent upon the lecturer's ability to be clear, witty, organized and entertaining, nor upon the student being present, alert, receptive and attentive. In addition to reducing the amount of preparation time, the unit questions serve to put an end to the so called game of "psyching out" the instructor as to what is or isn't important. One student commented that the unit study guides have helped her learn to identify important points in other courses. Assurance that completing a quiz is the occasion for a reinforcing event is provided through the encouragement of students to verify the correctness of their answers to the study questions prior to the quiz. Further, for the student reading the material, the unit assignment presents the instructor's view points at a time when it is impractical or impossible for the instructor to be present. Finally, answering the unit questions encourages recitation which has been suggested as a good study habit. Relevant to these advantages are the questionnaire data indicating that students said that their course responsibilities were well specified and grading system very fair.

Another factor for comparison is the speed at which a student moves through an educational program. The rate of progress can be under the instructor and/or student's control. The present program and that of Malott and Svinicki's (1969) is instructor paced in that students must complete a variable amount of material per unit time, and they cannot go faster than the pace set by the instructor. Malott and Svinicki (1969) have noted that giving daily quizzes has the desirable consequence of maintaining a steady rate of

studying which serves to eliminate cramming. The weekly quiz in the present program does allow for some cramming, but on the other hand involves much less administration. In addition to eliminating or reducing cramming, frequent assessments of each student's developing repertoire for the subject matter provides a monitoring system which allows for the early identification of learning and/or outside problems. Being able to take immediate action on these identified problems has obvious advantages over traditional assessments which often allow six to eight weeks to pass before the first assessment. If one chooses to adopt instructor pacing, the amount of material to be covered per unit time must be adjusted to the difficulty. Student feedback and the instructor's past experience are two aids in determining difficulty.

Johnson and Pennypacker (1971) and Myers (1970) both employ programs that allow the student to partially determine the rate at which he proceeds through the course material. It is hypothesized that allowing the student to proceed through the course faster than normal will be reinforcing. The potential source of the reinforcement could be either terminating an aversive situation (the course) sooner, and/or acquiring knowledge faster. The amount and source of reward for being allowed to proceed at your own pace needs to be systematically evaluated. While Johnson and Pennypacker (1971) demand a certain minimum rate of progress throughout the course, Myers (1970) simply allows the student to move as fast as he wishes with the knowledge he will receive an "F" or "incomplete" if he does not finish his assignments by the end of the semester. Allowing the student to proceed at his own pace produces a considerable amount of administrative work as well as the need to create

alternative quizzes or maintain tight test security.

One final factor to compare among the different educational programs is the grading system used. All of the previously discusses programs provide for relatively immediate knowledge of results. In the case of Johnson and Pennypacker (1971) the student is informed of his accuracy after responding to each test item, whereas in the other systems including the present one, knowledge of results is slightly delayed until the student has progressed through all test items. All of these programs are more efficient than the traditional lecture discussion methods of assessment which usually violate the principle of immediate feedback by days and weeks. To provide immediate knowledge of results requires the use of automated machines and/or the use of a number of graders depending upon the size of the class. Malott and Svinicki (1969) and Johnson and Pennypacker (1971) use a pool of student proctors who have previously taken the course. These students receive credit for their work, and under their programs have functioned quite well.

The present program used student graders chosen semi-randomly from the class. This selection method may encourage some students to take a chance on being a grader that week and therefore, not study. While data from another introductory psychology honors course indicated that 85% of the students always prepared for the quiz, the author now requires all chosen graders and two alternates to turn in completed study quides for inspection prior to the quiz. If one of the graders cannot pass the quiz on the basis of his answers, an alternate is chosen to take his place. This revised system

insures that all graders have prepared adequate answers to the study guide questions. To insure correct and fair grading, the graders examine the correct answers with the instructor, and are penalized half the point value of any question the instructor later identifies as incorrectly graded. One advantage of using classmates as graders is the elimination of the contingency system and other administrative detail necessary in the case of student proctors.

Whether or not a teacher should demand that each student acquire all the subject matter of a course is perhaps both a philosophical and practical question. On the practical side, the type of contingency management used in the present study would seem essential for generating sequential behaviors such as found in a typical sequence of college calculus courses. For example, of what value is a D's worth of knowledge in Calculus I for the student who wishes to take Calculus II ? It could be argued that a D's worth of knowledge would be of some value in a course which presents a variety of material representing heterogenous links in a chain of behavior. However, if one takes the philosophical position that the goal of education is to teach all the subject matter of the course, not three-quarters or one-half, then it seems reasonable that we employ techniques that fulfill this objective. It is encouraging that the responses to the course evaluation questionnaire indicated that most students felt the comprehension of the material was above average and that further their course experience stimulated them to take other related courses. Although no direct comparison was made to comparable courses, the above average compre-

hension rating by the students supports McMichael and Corey's (1969) results demonstrating the greater effectiveness of contingency managed courses over traditional lecture methods.

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Footnote

1 Reprints may be obtained from the author at the Department of Psychology, Washington State University, Pullman, Washington 99163. The initial idea behind this project was learned while the author was a graduate student of Professor Jack Michael. I wish to thank Helene Burgess, Margaret Lloyd and William Knowlton for their assistance in preparing unit assignments, and Professor Kenneth Lloyd for his advice and criticisms.

Table 1

Frequency Distributions of Number of Repeated Quizzes and of Number of Quizzes with a Grade of "B"

		Number of Quizzes Repeated								Number of Quizzes with Grade of B							
		0	1	2	3	4	5	6	7	0	1	2	3	4	5	6	7
Course	N																
Experimental Analysis of Behavior	55	21	14	9	4	2	1	2	2	8	12	18	6	7	1	2	1
Introductory Psychology Honors Section	28	22	3	3	0	0	0	0	0	7	13	3	3	2	0	0	0
Introductory Psychology Nightclass	5	0	2	2	0	0	1	0	0	0	2	0	0	2	0	0	1

Note.- The introductory sections completed 13 quizzes during the semester. The experimental analysis of behavior course completed 14 quizzes.

Table 2

Selected Items from Washington State University
Course Evaluation Questionnaire

Number	Item
1	How well have you been able to understand the content of this course? (1) Beyond my comprehension (2) Very difficult for me (3) About my level of comprehension (4) Understood most of the material fairly well (5) No difficulty in comprehending the materials or ideas.
2	How important were the class sessions to your achievement? (1) Little or no value (2) Some value (3) Generally valuable (4) Quite valuable (5) Outstanding in value
3	How much work outside of class did you do for this course in relation to the credit hours involved? (1) None (2) Very little (3) About average (4) Somewhat more (5) Much more
4	How clearly were your responsibilities in the course defined? (1) I was often in doubt about what was expected (2) I was occasionally in doubt (3) I usually knew what was expected (4) I usually knew exactly what was expected (5) I always knew exactly what was expected
5	What interest would you have in taking other courses in this general area of study? (1) None (2) Minimal interest (3) Moderately interested (4) Very interested (5) Extremely interested
6	Were you satisfied with the grading procedures used in this course? (1) Grading system not defined; I didn't know what to expect (2) Rather dissatisfied (3) They were satisfactory (4) Better than most systems (5) Grading system seemed well defined, and students knew what was expected

Table 3

Average Ratings of Items in Course Evaluation Questionnaire

Item	Courses		
	Experimental Analysis of Behavior	Honors Introductory Psychology	Nightclass Introductory Psychology
1. Comprehension of Content	3.87 3.67[a]	4.65 3.89[b]	4.80 3.67[a]
2. Importance of Attending Class	1.63 3.27	2.76 3.34	4.20 3.27
3. Outside work	3.67 3.56	3.15 3.33	4.20 3.56
4. Specification of Student Responsibilities	4.50 3.40	4.73 3.36	4.60 3.40
5. Pursuit of Related Courses	3.33 2.88	3.57 3.16	4.00 2.88
6. Satisfaction With Grading	4.52 3.16	4.84 3.15	4.60 3.16

Note.- Top number is the average rating from (1) low to (5) high and bottom number is the norm for non-programmed courses.

[a]Norm based on average of 2,124 students responding in 48 classes.

[b]Norm based on average rating of 6,547 students responding in 194 classes.